A polarized view of the world

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Until recently there were few polarized observations of the atmosphere of the Earth and the spectral range and accuracy of the available observations was somewhat limited. Over the last two decades new instruments that make highly accurate polarimetric observations over a wide spectral and angular range have been developed. Although the primary impetus for this development was to reduce uncertainties in the radiative properties of aerosols such measurements can also be applied to the remote sensing of clouds. For example, polarized observations can be used to estimate the droplet size distributions of water clouds and determine the shape and roughness of the crystals in ice clouds. By making polarimetric observations in closely spaced spectral bands, with and without absorption, assumptions required in deriving cloud macrophysical properties, such as the number concentration and physical thickness of clouds can be eliminated. While historically aerosol and cloud retrievals from satellite have been applied to separate pixels where either aerosols, or clouds dominated the observed signal, more recently the importance of detecting and characterizing aerosols above clouds has been recognized. As our understanding of the information contained in polarimetric observations improves it is clear that the use of such observations for characterizing aerosols under thin cirrus clouds and in the gaps between clouds will also become part of our repertoire for the passive remote sensing of aerosols and clouds. In this talk we summarize these developments and point to new approaches for combining active and passive measurements to extend the capabilities for remotely sensing the Earth from space.

References

[1] Cairns, B., F. Waquet, K. Knobelspiesse, J. Chowdhary, and J.-L. Deuzé, 2009: Polarimetric remote sensing of aerosols over land surfaces. In *Satellite Aerosol Remote Sensing over Land*, edited by A. A. Kokhanovsky and G. De Leeuw, Springer, Berlin, pp. 295–325.